PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

HALL, S., Warren
Dennison Associates
Suite 301
133 Richmond Street West
Toronto, Ontario M5H 2L7
CANADA

Date of mailing (day/month/year)
29 September 2000 (29.09.00)

Applicant's or agent's file reference

IMPORTANT NOTIFICATION

International application No.
PCT/CA99/01216

International filing date (day/month/year)
23 December 1999 (23.12.99)

1. The following indications appeared on record concerning:

[X] the applicant [X] the inventor [ ] the agent [ ] the common representative

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LaSalle, Ontario N9J 2C3
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State of Nationality: **
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Telephone No.:
Facsimile No.:
Teleprinter No.:

2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

[ ] the person [ ] the name [ ] the address [X] the nationality [ ] the residence

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State of Nationality: CA
State of Residence: CA
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland
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Authorized officer
Maria Victoria CORTIELLO
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PATENT COOPERATION TREATY

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International filing date (day/month/year)
23 December 1999 (23.12.99)

1. The following indications appeared on record concerning:

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CANADA

Date of mailing (day/month/year)
29 September 2000 (29.09.00)

Applicant's or agent's file reference

IMPORTANT NOTIFICATION

International application No.
PCT/CA99/01216

International filing date (day/month/year)
23 December 1999 (23.12.99)

1. The following indications appeared on record concerning:

[X] the applicant [X] the inventor [ ] the agent [ ] the common representative

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3. Further observations, if necessary:

4. A copy of this notification has been sent to:

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[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
[X] the elected Offices concerned
[ ] other:

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PATENT COOPERATION TREATY

PCT

NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92bis.1 and Administrative Instructions, Section 422)

From the INTERNATIONAL BUREAU

To:

HALL, S., Warren
Dennison Associates
Suite 301
133 Richmond Street West
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CANADA

Date of mailing (day/month/year)
28 August 2000 (28.08.00)

Applicant's or agent's file reference

IMPORTANT NOTIFICATION

International application No.
PCT/CA99/01216

International filing date (day/month/year)
23 December 1999 (23.12.99)

1. The following indications appeared on record concerning:

[X] the applicant [X] the inventor [ ] the agent [ ] the common representative

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State of Residence: CA
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Teleprinter No.:

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[ ] the person [ ] the name [X] the address [ ] the nationality [ ] the residence

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State of Residence: CA
Telephone No.:
Facsimile No.:
Teleprinter No.:

3. Further observations, if necessary:

4. A copy of this notification has been sent to:

[X] the receiving Office
[ ] the International Searching Authority
[X] the International Preliminary Examining Authority
[ ] the designated Offices concerned
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PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
WH10340-1WO		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/CA99/01216	23/12/1999	23/12/1998
International Patent Classification (IPC) or national classification and IPC G06T11/60		
Applicant TRUESPECTRA INC. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 10 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 12 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the report
   - II ☐ Priority
   - III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☐ Lack of unity of invention
   - V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations suporting such statement
   - VI ☐ Certain documents cited
   - VII ☒ Certain defects in the international application
   - VIII ☒ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
21/07/2000	15.03.2001
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized officer Müller, M Telephone No. +49 89 2399 7409

Form PCT/IPEA/409 (cover sheet) (January 1994)

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/CA99/01216

I. Basis of the report

1. This report has been drawn on the basis of *(substitute sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments (Rules 70.16 and 70.17).)*:
Description, pages:

2,5-17,19-32	as originally filed	
1,3,4,4a	with telefax of	08/01/2001

Claims, No.:

1-19	with telefax of	08/01/2001

Drawings, sheets:

1/11-9/11,11/11	as originally filed	
10/11	with telefax of	08/01/2001

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   - ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
   - ☐ the language of publication of the international application (under Rule 48.3(b)).
   - ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   - ☐ contained in the international application in written form.
   - ☐ filed together with the international application in computer readable form.
   - ☐ furnished subsequently to this Authority in written form.
   - ☐ furnished subsequently to this Authority in computer readable form.
   - ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
   - ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

☒ the description, pages: 18
☐ the claims, Nos.:
☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)):

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-15 (if clarified)
	No:	Claims	16-19
Inventive step (IS)	Yes:	Claims	1-15 (if clarified)
	No:	Claims	16-19
Industrial applicability (IA)	Yes:	Claims	1-19
	No:	Claims	

2. Citations and explanations
see separate sheet

VII. Certain defects in the international application

The following defects in the form or contents of the international application have been noted:
see separate sheet

VIII. Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:
see separate sheet

Citations

Reference is made to the following documents:

D1: WO 98 37487 A (TRUESPECTRA INC) 27 August 1998
D2: EP-A-0 703 550 (CANON KK) 27 March 1996
D3: US-A-5 428 724 (SILVERBROOK KIA) 27 June 1995

V: Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Due to the large number of independent claims (see item VIII.7) and substantial clarity problems (see item VIII.8 and 9) a final assessment of novelty and inventive step of all claims on file is impossible. However, a tentative assessment is given and a brief outline what amendments might have been possible to obtain claims in conformance with Article 33 (1-3) PCT.

2 Document D1 is the closest piece of prior art with respect to all claims on file. Claim 17 is considered first.

2.1 D1 discloses a system for rendering (ie, a "render engine": eg, title and abstract) a defined image

on a scanline by scanline basis (eg, page 11, line 21 - page 12, line 6; esp., page 11, lines 25-26)

which uses a hierarchy of interacti[ng] objects and each object includes output information (eg, page 10, lines 28-32; page 11, lines 21-30, esp. line 25; page 12, lines 7-26),

said render engine analysing said output information of said interacti[ng] objects from the lowest to the highest interacti[ng] object and determining the output required of each object (eg, page 12, lines 9-12)

whereby each object outputs the required number of scanlines necessary as input for higher rank objects to cause the uppermost object to output a scanline, each object passing the required number of scanlines as input for the next highest object (eg, page 12, line 27-36) and repeating the process until the highest ranked object and repeating the process until the highest ranked object produces the

particular scanline of the image (eg, page 12, line 36 - page 13, line 5),

and repeating the process for the next scanline of the image until the entire images has been rendered (eg, page 11, lines 33-34).

2.1 With respect to the interpretation suggested by the mentioned references into D1 it is noted that claim 17 does not enforce any particular meaning of objects being "interactive" / "active" and "hierarchically" organised which would go beyond the activity and hierarchical arrangement of objects disclosed in D1 (eg, par. bridging pages 12 and 13).

Secondly, for images comprising only standard graphic "objects" (ie, no blur or colour fade; cf. item VIII.8.1 below) the step of "determining the ... required number of scanlines ..." is trivial because for each output scanline at most one input scanline per object is needed.

Thirdly, even if there are "blur" objects, D1 indeed teaches to proceed (mainly) from the lower most to the upper most object with a repetitive process, during which each object passes the required number of scanlines as input (maybe in chunks) to the next highest object and ultimately to the highest ranked object which then produces a scanline (see item VIII.8). It should be observed that this strategy also ends up "determining" the relevant scanlines of each object for rendering a particular scanline.

2.2 As a consequence, the subject matter of claim 17 is fully anticipated by D1, in violation of Article 33 (2) PCT. By essentially the same argument it is considered that claims 16 and 18 violate Article 33 (2) PCT as well. The additional subject matter of claim 19 is known from D1 as well (page 19, lines 16-23).

3 Generally speaking, the same analysis applies also to claims 1, 9 and 12, in particular insofar as the essential features of the invention (see item VIII.8) are concerned.

3.1 With respect to the "look around distance" or "factor" mentioned in claims 1, 9 and 12 it should be observed that D1 indeed discloses the use of "look around objects" storing a LookAround distance (page 13, lines 9-23; page 18, lines 4-21) defining additional input information required by the object to allow the object to output a scanline.

Second, note that claims 1, 9 and 12 specify that a "hierarchy of objects" be determined (eg, claim 1, step a; claim 9, page 21, lines 12-15; claim 12, lines 14-17) by selection on a scanline-by-scanline basis (wording of claim 9).

Third, while D1 does not teach explicitly to determine such a (sub-)hierarchy it is considered that such a subhierarchy is implicitly obtained by traversing the complete hierarchy of objects according to the strategy depicted, for instance, in figure 6 of D1.

3.1 The latter difference is taken to suggest a substantial modification of the strategy of D1 according to the invention - namely to speed up rendering by making use of predetermined information about which object (of those to be imaged) affects which part of the image to be rendered (cf, in particular, item VIII.8).

3.2 For this reason it is considered appropriate to assess claims 1, 9 and 12 positively (under the proviso of the mentioned clarity problems) in contrast to claims 16-18.

This acknowledges that the subject matter disclosed in the description (even though insufficiently specified in the claims; cf. item VIII.8) does indeed conform with Article 33 (1-3) - and that claims 1, 9 and 12 reflect this subject matter better than claims 16-19.

4 With respect to the dependent claims, only claims 6-8 and 13 appear to specify subject matter which could, on its own, have been the basis for a claim in conformance with Article 33 (1-3) PCT:

4.1 It is known to add colour and transparency characteristics to graphical objects to be rendered (eg, D2, page 5, lines 22-27 and D3, col. 1, lines 37-44). Thus, incorporating colour and an "alpha channel factor" in each object as suggested in claims 2, 3, 10 and 15 does not establish an inventive step over the prior art, Article 33 (3) PCT.

4.2 A background object according to claim 4 is known from D1 (eg, page 12, lines 28-30) and modelling it as a transparent object according to claim 5 appears to represent an obvious alternative.

4.3 The recursive decomposition of the hierarchy by render layer objects which them-

selves comprise a hierarchy of interacti[ng] objects according to claims 6-8 and 13 is not disclosed or suggested by document D1 or any of the other documents on file.

VII: Certain defects in the international application

4 All independent claims should have been drafted in two-part form based on document D1 as the closest piece of prior art (Rule 6.3 (b) PCT).

5 The claims do not contain reference signs, in contrast to the requirements of Rule 6.2 (b) PCT.

6 The U. S. Patent Application No. SN 08/629,543 on page 3, line 1, should have been replaced by the corresponding publication number which appears to be US-A-5 903 277.

VIII: Certain observations on the international application

7 The presence of a number of independent claims (here 1, 9, 12, and 16-18) specifying different features, or apparently corresponding features in different terms (for examples, see the objections to follow), leads to a lack of clarity as to what the applicant considers to be the features necessary to the invention and how those features are to be defined. Thus the matter for which protection is sought is unclear (Article 6 PCT).

Moreover, claims 9 and 12 comprise all the features of claim 16 and should thus have been drafted as claims dependent on claim 16 rather than independent ones (Rule 6.4 (a) PCT).

8 All claims suffer from two clarity problems which are particularly severe since they relate to the contribution of the invention over the prior art.

8.1 The technical problem which the invention sets out to solve occurs only if the "hierarchy of objects" defining the image comprises at least one object that indeed does "affect more than one scanline" in the image. For clarity reasons and also for clear delimitation from the prior art it should have been made explicit that the

objects' "regions" (eg, claim 1, line 3) may intersect with more than one scanline.

8.2 In brief, the invention contributes a way to render an image in a single pass touching each object at most once where D1 would have needed to address certain objects more than once. This is not unambiguously clear from the claims.

For instance, claim 17 specifies that "each interactive object pass[es] the required number of scanlines as input for the next highest active object" and "repeating the process until the highest ranked active object produces the ... scanline". This is arguably also the case in D1 even though the passing of scanline information follows a different pattern.

More vaguely even, claim 18 specifies to "determine the required input and output information for each object" and "using said ... objects from lowest to highest to output the required information for the highest ranked object to output a scanline". It is not made explicit exactly when and in which chunks said information is "determined" and passed along the object hierarchy.

Likewise, none of the claims specifies that the "required number of scanlines" be passed at once to the next highest object.

9 The claims violate Article 6 PCT also for a number of additional reasons :

9.1 The concept of an "object" according to all independent claims is unclear. *A priori*, an "object" could refer to an image component in the abstract or to an object in the sense of an object-oriented implementation. According to the description, objects have both aspects (ad "image components" see, eg, in D1, page 10, lines 19-20; ad "object-orientation" consider the fact that objects are "active and can "output scanlines", eg, throughout the claims). This separate aspects should have been made clear in all claims.

Due to this confusion of concerns it is not clear (in terms of image processing terminology) what it means for an object (in the object-oriented sense) to "affect" an image region (eg, claim 1, lines 4 and 18).

9.2 In claims 1, 9 and 12 the phrase"additional input information required by the object to allow the object to output a scanline" is considered inappropriately vague because neither the kind of information is made clear nor for what it is "required".

A similar problem applies to the "scanline input information" of claim 16 and

the "object output requirements" of claim 18.

9.3 It is unclear in claims 1, 9, 12 and 16 in what sense the "object rendering information" is defined to "allow assessment of the interaction of the particular object with other objects without rendering".

Assuming that each object comprises only information about "a region of the image which the object affects" it would appear that no *"interaction"* between two objects can actually be determined *on the basis of just one of said objects.*

On the basis of the totality of all objects, however, it is trivially clear that such interaction is possible *without rendering.*

9.4 The term "the active objects" is introduced without an apparent antecedent in claims 1, 9, 12, and 16 which renders said claims unclear.

9.5 Adding to the confusion, claim 16 refers to "interactive objects" (another undefined term in this context) where the preceding claims refer to "active objects", and claim 17 refers to a "hierarchy of interactive objects" where the preceding claims refer to a hierarchy of "interacting" objects and claim 18 specifies only a "hierarchy of objects".

9.6 Claim 1 comprises the contradictory requirements that "an image defined by a hierarchy of interacting objects" *is given* but that the (apparently same) hierarchy *is to be defined* only as part of the claimed method (see, claim 1, lines 1-2 and 12-13).

9.7 The intended difference between a "LookAround distance" (claims 1 and 9) and a "look around factor" (claims 12 and 16) is unclear. None of said terms occurs in claims 17 and 18 which is considered to represent a lack of essential features.

Moreover, it is not clear from claims 1, 9, 12 and 16 that the LookAround parameter effectively also defines a region. As it stands, the role of said parameter within the claimed invention is considered to be underspecified.

9.8 The terms "render layers" (eg, claim 6, line 2) and "render objects" (eg, claim 13, lines 2-3) appear to denote the same entities. For clarity, consistent terminology should be used.

9.9 The term "adapted" used in claim 16 appears to have been misspelled by mistake and should rather read as "adopted". It should be noted that "adopted" as it stands would have to be interpreted as "being used" which would render the category of claim 16 ambiguous between "program" (ie, product) and "use".

9.10 Claim 17 does not state for which the "output ... of each object" is required (cf, claim 17, lines 6-7).

9.11 The category of claim 17 is unclear because it claims an system (a "render engine") in terms of method features ("said render engine analysing", "each interactive object passing", etc.).

TITLE: METHOD FOR ACCESSING AND RENDERING AN IMAGE

FIELD OF THE INVENTION

The present invention relates to a method for defining various objects which make up an image and a method of rendering the image on a scanline by scanline basis.

BACKGROUND OF THE INVENTION

There are a number of computer graphics programs which store various objects and use these objects to render the final image. Generally these programs are divided into vector based programs or bitmap based programs. COREL DRAW™ is primarily vector based whereas PHOTOSHOP™ is essentially bitmap based. These known graphics packages allocate enough temporary storage for the entire rendered image and then render each object, one by one, into that temporary storage. This approach fully renders lower objects prior to rendering upper objects. The programs require substantial memory in rendering the final image. Some programs allow an object to be defined as a group of objects and this provides some flexibility. In the case of an object being a group of objects, this group is effectively a duplicate of the base bitmap. Groupings of objects add flexibility in changing the design or returning to an earlier design, but substantial additional memory is required. Changing any object of the image typically requires rerendering of the entire image

The final image of graphics packages is typically sent to a raster device for output, which renders the image on a scanline by scanline basis. The final image

Our earlier U.S. Patent application SN 08/629,543 entitled Method Rendering an Image allows for scanline based rendering and divides all objects into a tool and region. It is possible to use the region as a local alpha channel for the tool. This doesn't allow for a more general use of alpha channels to create holes in images when used, for example, on web pages -- showing through the background. Also some types of objects such as formatted text with color highlighting cannot be represented easily with a separate region (as the shape of the text), and tool (with the coloring for the text) since particular words need to have different colors, and these need to follow the words when the text is reformatted.

Our prior application WO98/37487 discloses a method and program for rendering an image based on a hierarchy of objects which can take different forms and rendering the image on a scanline by scanline basis. The method initially assumes only one scanline of output from each object is required to produce the desired scanline and each object produces and outputs the initial information and provides it to the next highest object. If additional information is required, the lower objects are returned to and the process repeated until the desired scanline is obtained. Thus, to produce a desired scanline, an object may be requested several times to produce additional output. The present method and program conduct a pre-evaluation of the objects whereby each object outputs the required information to return a scanline without making multiple requests to an object for a given scanline. This approach is more efficient and allows a single pass through the objects.

SUMMARY OF THE INVENTION

A method of rendering an image defined by a hierarchy of interacting object according to the present invention comprises

defining each object specifying a region of the image which the object affects, a LookAround distance defining additional input information required by the object to allow the object to output a scanline,

determining for each object rendering information which allows assessment of the interaction of the particular object with other objects without rendering thereof, said rendering information comprising said region and said LookAround distance,

defining a hierarchy of said objects which collectively define the image, and

rendering scanlines of said image by determining for each scanline

a) a hierarchy of the active objects which affect the particular scanline of the image,

evaluating the hierarchy of active objects and the rendering information thereof to determine the number of scanlines to be outputted by each active object to render the particular scanline of the image,

using the results of the evaluation of the hierarchy of objects to cause the lowest active object to output the required number of scanlines and pass the scanlines as input for the next highest active object and repeating the process until the highest ranked active object produces the particular scanline of the image, and repeating the process for the next scanline of the image until the entire image has been rendered.

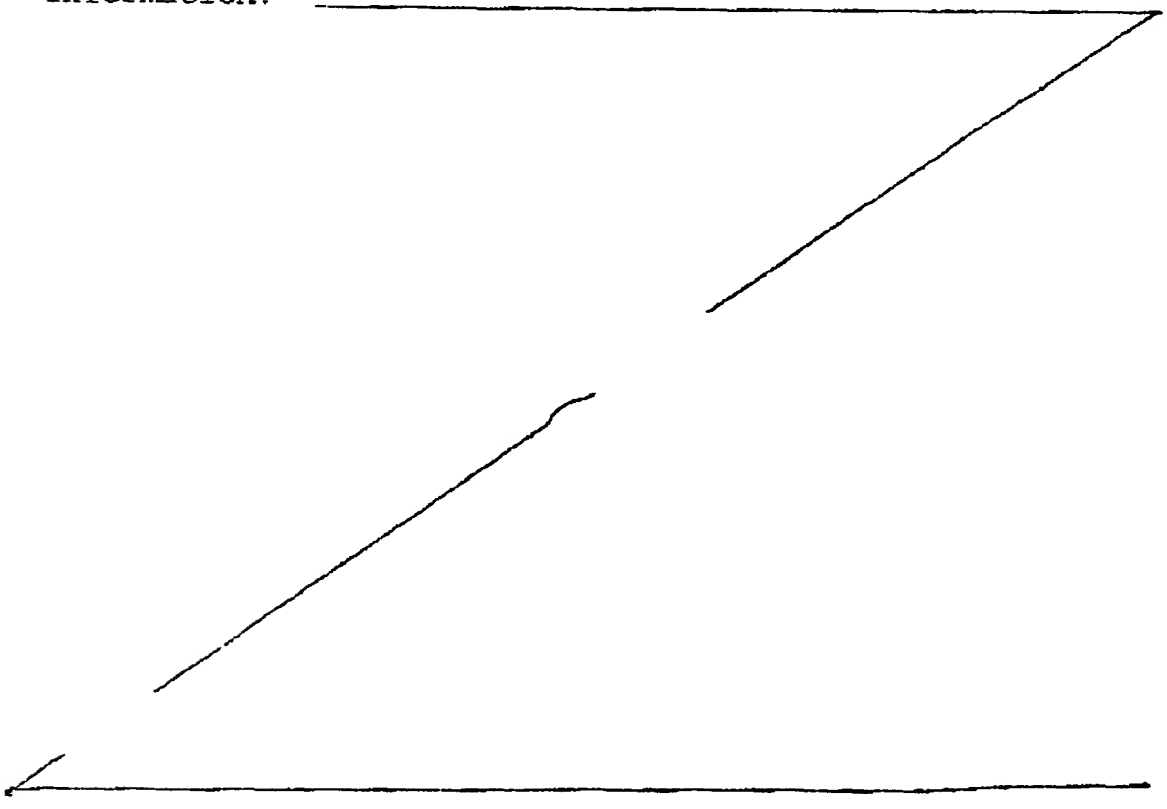
According to an aspect of the invention, the method includes the step of defining each object including an alpha channel factor for transparency characteristics of each object.

According to an aspect of the invention, the alpha channel factor of each object is included in said rendering information.

In a further aspect of the invention, the hierarchy of objects includes a background object which is applied as the last active object using said alpha channel factors of said active objects.

In a further aspect of the invention, the lower most active object an input corresponding to a transparent object.

In an additional aspect of the invention at least some of said objects are render layers where each render layer is defined by a separate hierarchy of interacting objects defined in the same manner and each render layer has render layer information corresponding to object rendering information such that said render layers are treated as normal objects relative to higher and lower objects and evaluation of a hierarchy of objects is based on said object rendering information and said render layer information.



THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A method of rendering an image defined by a hierarchy of interacting objects, said method comprising

defining each object specifying a region of the image which the object affects, a LookAround distance defining additional input information required by the object to allow the object to output a scanline,

determining for each object rendering information which allows assessment of the interaction of the particular object with other objects without rendering thereof, said rendering information comprising said region and said LookAround distance,

defining a hierarchy of said objects which collectively define the image, and

rendering scanlines of said image by determining for each scanline

a) a hierarchy of active objects from said hierarchy of objects where each active object is selected as it affects the particular scanline of the image,

b) evaluating the hierarchy of active objects and the rendering information thereof to determine the number of scanlines to be outputted by each active object to render the particular scanline of the image, and

c) using the results of the evaluation of the hierarchy of objects to cause the lowest active object to output the required number of scanlines and pass the scanlines as input for the next highest active object and repeating the process until the highest ranked active object produces the particular scanline of the image, and repeating the process for the next scanline of the image until the entire image has been rendered.

2. A method as claimed in claim 1 wherein said step of defining each object includes defining an alpha channel factor for transparency characteristics of each object.

3. A method as claimed in claim 2 wherein said alpha channel factor of each object is included in said rendering information.

4. A method as claimed in claim 3 wherein said hierarchy of objects includes a background object which is applied as the last active object using said alpha channel factors of said active objects.

5. A method as claimed in claim 3 including providing to said lower most active object an input corresponding to a transparent object.

6. A method as claimed in claim 4 wherein at least some of said objects are render layers where each render layer is defined by a separate hierarchy of interacting objects defined in the same manner and each render layer has render layer information corresponding to object rendering information such that said render layers are treated as normal objects relative to higher and lower objects and evaluation of a hierarchy of objects is based on said object rendering information and said render layer information.

7. A method as claimed in claim 6 wherein some of said render layers are defined as a hierarchy of objects and at least one render layer.

8. A method as claimed in claim 7 wherein said hierarchy of active objects and render layers is used during rendering to form a hierarchy series of alpha channel factors used to determine the transparency associated with each pixel of each scanline.

9. A draw rendering program which defines an image as a compilation of hierachial interacting objects; each

~~object~~ being defined by a region of the image which the object affects, a LookAround distance defining scanline input information required by the object to allow the object to output a scanline, and data information of the object which includes defining the data information using vector based techniques or bitmap techniques;

the definition of each object including rendering information which allows assessment of the interaction of the particular object with other objects without rendering thereof, said rendering information comprising said region and said look around distance,

an arrangement for determining on a scanline by scanline basis a hierarchy of said objects which collectively define the image and the required output of each object to return a particular scanline,

a render engine for rendering a defined image on a scanline by scanline basis which uses said hierarchy of the active objects and the rendering information thereof to determine the number of scanlines to be outputted by each active object to render the particular scanline of the image,

said render engine using the results of the evaluation of the hierarchy of objects to cause the lowest active object to output the required number of scanlines typically corresponding to only a small portion of the object and pass the scanlines as input for the next highest active object and repeating the process until the highest ranked active object produces the particular scanline of the image, and repeating the process for the next scanline of the image until the entire image has been rendered.

10. A draw rendering program as claimed in claim 9 including with each interactive object color and alpha channel information which defines the color and the transparency of the interactive object.

11. A draw rendering program as claimed in claim 10 including defining the lowest object as a transparent background object and defining a desired background as the upper most object.

12. A draw rendering program which defines an image as a compilation of hierachial interacting objects; each object being defined by a region of the image which the object affects, a look around factor defining scanline input information required by the object to allow the object to output a scanline, and data information of the object used during rendering of the object;

the definition of each object including rendering information which allows assessment of the interaction of the particular object with other objects without rendering thereof, said rendering information comprising said region and said look around factor,

an arrangement for determining object output information for any particular scanline, said object output information including a hierarchy of said interactive objects which collectively define the scanline of the image and the required output of each interactive object required by the next highest interactive object to return the particular scanline,

a render engine for rendering a defined image on a scanline by scanline basis which uses said object output information from the lowest to highest interactive objects to cause each interactive object to output the required number of scanlines and pass the scanlines as input for the next highest active object and repeating the process until the highest ranked active object produces the particular scanline of the image, and repeating the process for the next scanline of the image until the entire image has been rendered.

13. A program as claimed in claim 12 wherein said interactive objects include simple objects and render

objects where a simple object is defined by a single interactive object and a render object is defined by its own hierarchy of interactive objects, each render object including its own render information whereby render information of a render object allows other objects in a hierarchy with a render object to use the render information thereof as if the render object was a simple object.

14. A program as claimed in claim 13 including a rerendering assessment arrangement for rerendering only a portion of a rendered image which has changed due to a change in at least one of said active objects, said assessment arrangement identifying the changed active objects and the scanlines of the rendered image affected by the changed objects and rerendering the required scanlines to replace affected scanlines of the image whereby only a portion of the scanlines of the image are rerendered.

15. A program as claimed in claim 14 wherein said rendering information of each object includes an alpha channel factor which defines transparency characteristics of each object.

16. A draw rendering program adopted for defining an image as a compilation of hierachial interacting objects; each object being defined by a region of the image which the object affects, a look around factor defining scanline input information required by the object to allow the object to output a scanline, and data information of the object defined using vector based techniques or bitmap techniques;

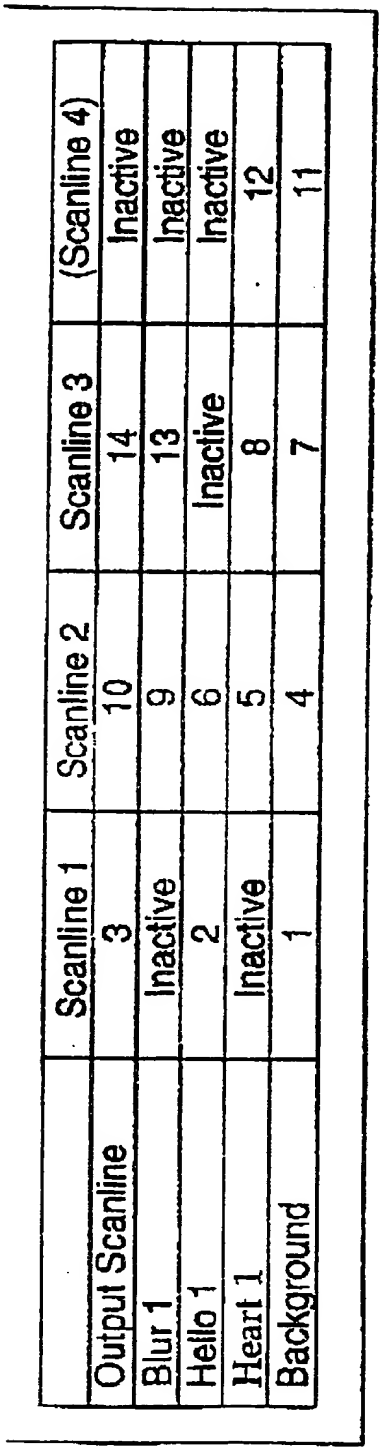
the definition of each object including rendering information which allows assessment of the interaction of the particular object with other objects without rendering thereof, said rendering information comprising said region and said look around factor,

an arrangement for determining object output information for any particular scanline or group of scanlines, said object output information including a hierarchy of said interactive objects which collectively define the scanline of the image and the required output of each interactive object required by the next highest interactive object to return the particular scanline or group of scanlines..

17. A render engine for rendering a defined image on a scanline by scanline basis which uses a hierarchy of interactive objects and each object includes output information, said render engine analysing said output information of said interactive objects from the lowest to highest interactive objects and determining the output required of each object whereby each interactive object outputs the required number of scanlines necessary as input for higher rank objects to cause the upper most object to output a scanline, each interactive object passing the required number of scanlines as input for the next highest active object and repeating the process until the highest ranked active object produces the particular scanline of the image, and repeating the process for the next scanline of the image until the entire image has been rendered.

18. A method of defining an image comprising defining a hierarchy of objects where at lest some of said objects are active objects requiring at least several lines of output from lower objects, each object including object output requirements necessary for the object to output a scanline input for the next highest object, analysing said hierarchy of objects and determining the required input and output information of each object to return a scanline of the image and using said interactive objects from lowest to highest to output the required information for the highest ranked object to output a scanline.

19. A method as claimed in claim 18 including rerendering only a portion of an image affected by a change in one of said objects by analysing said hierarchy of objects to determine the scanlines of the image affected by the change in the objects and rerendering the changed scanlines to update the image.



	Scanline 1	Scanline 2	Scanline 3	(Scanline 4)
Output Scanline	3	10	14	Inactive
Blur 1	Inactive	9	13	Inactive
Hello 1	2	6	Inactive	Inactive
Heart 1	Inactive	5	8	12
Background	1	4	7	11

FIG.10

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 509 110 A (LATHAM ROY W) 16 April 1996 (1996-04-16) column 3, line 33 -column 7, line 11; figures 2,3	1,12, 16-18
A	US 5 428 724 A (SILVERBROOK KIA) 27 June 1995 (1995-06-27) column 2, line 9 - line 50; claims 1-6; figures 2-6	1,12, 16-18

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PCT/CA 99/01216

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